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DMC

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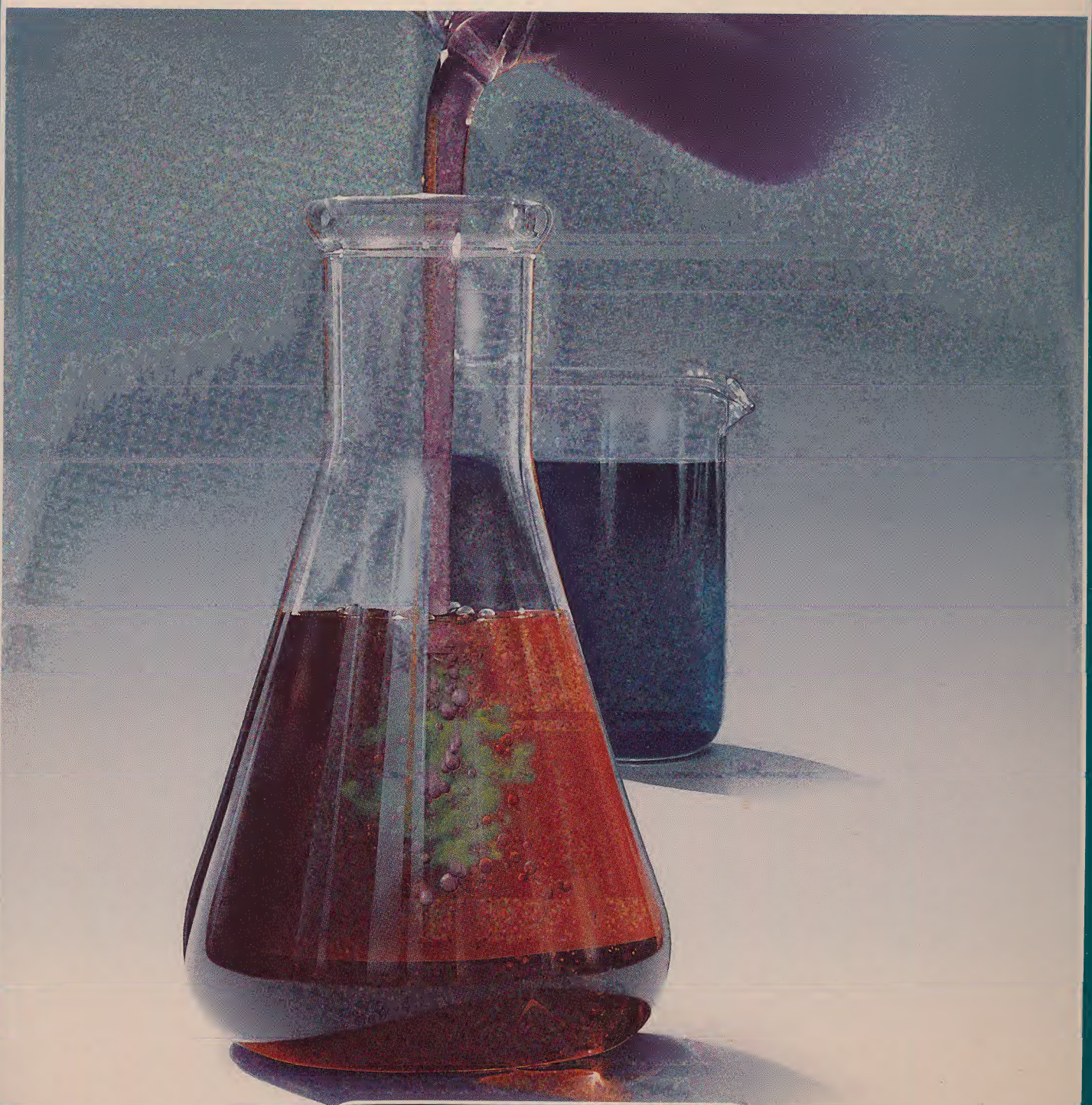
ScienceWorks

Investigating Chemical Reactions



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Investigating Chemical Reactions
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57 21C 15
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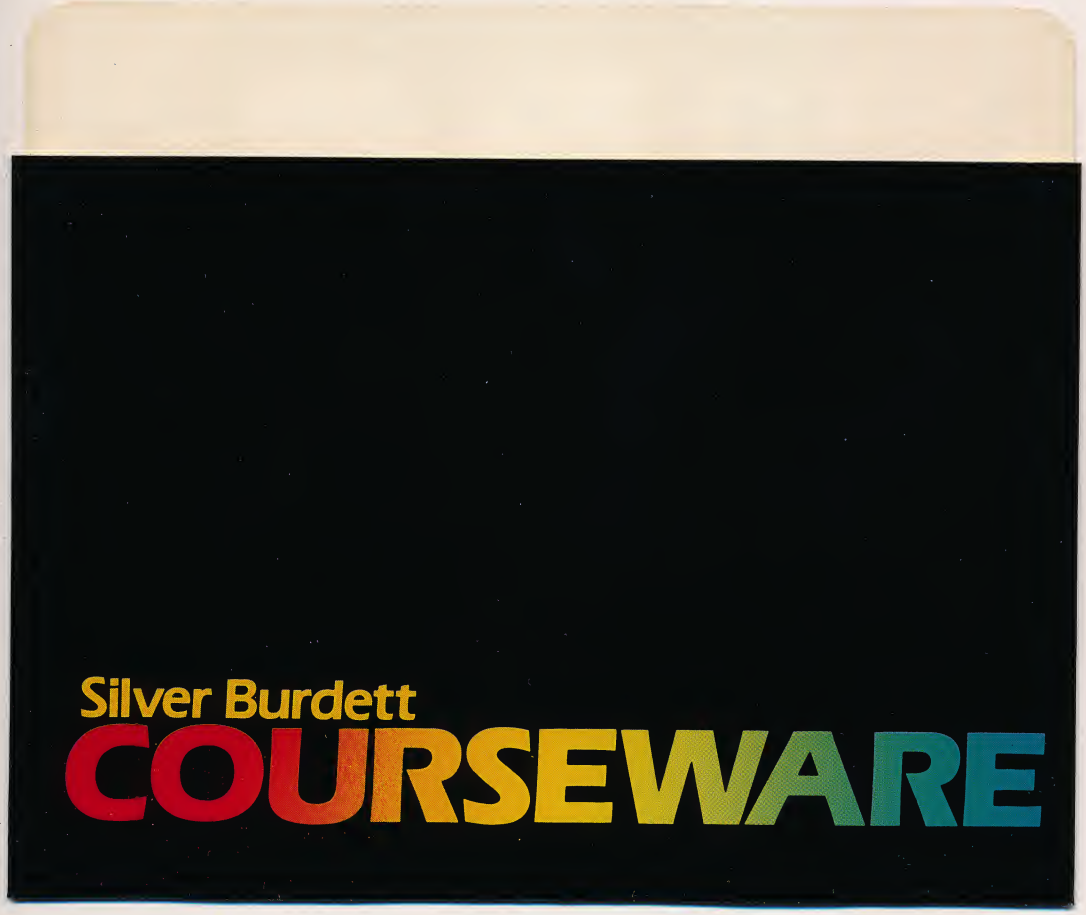
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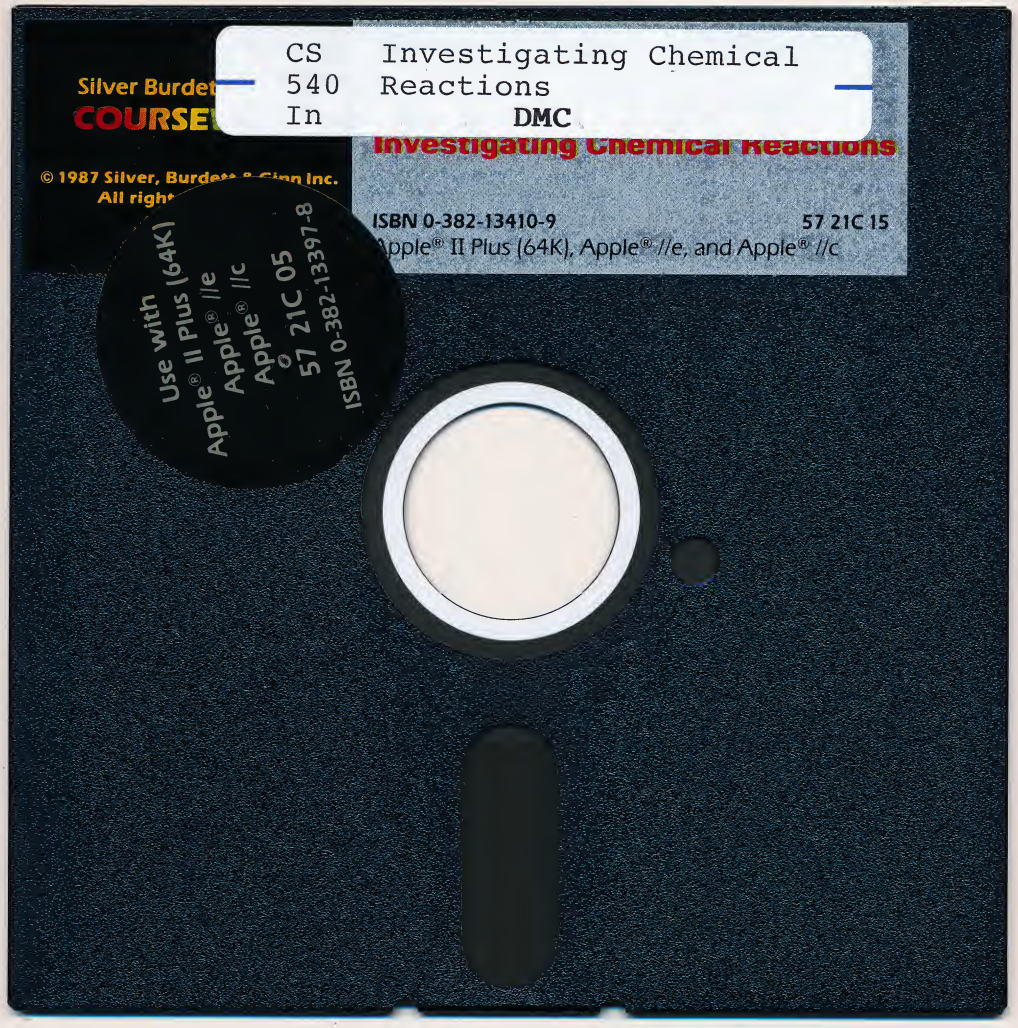
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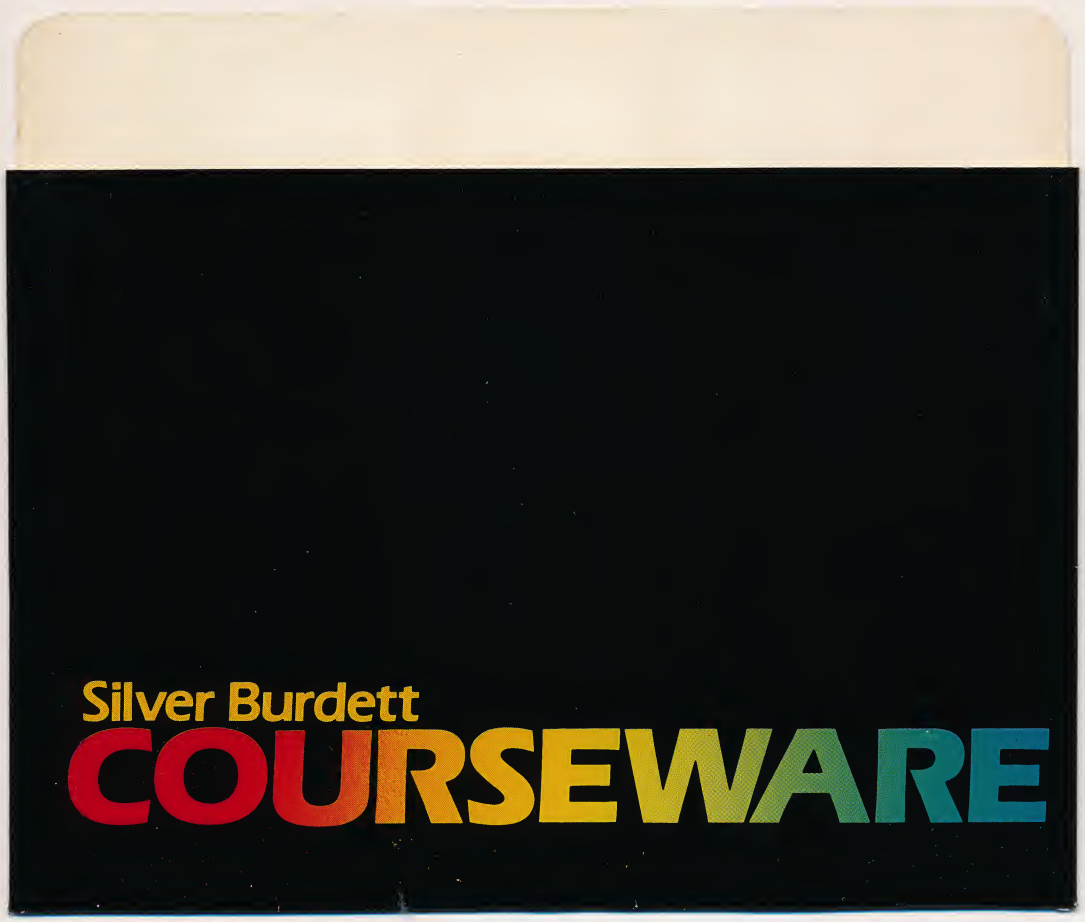
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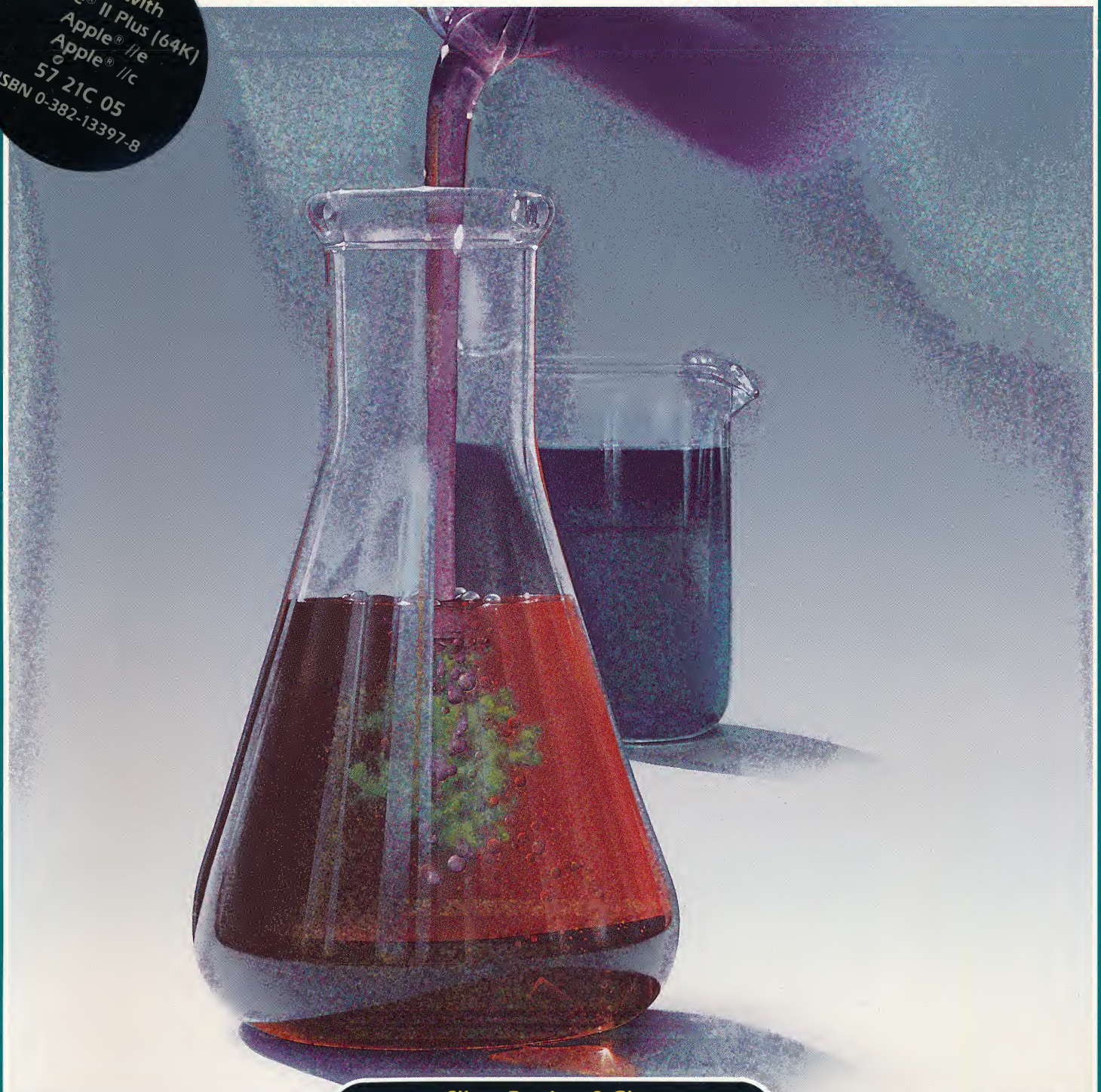

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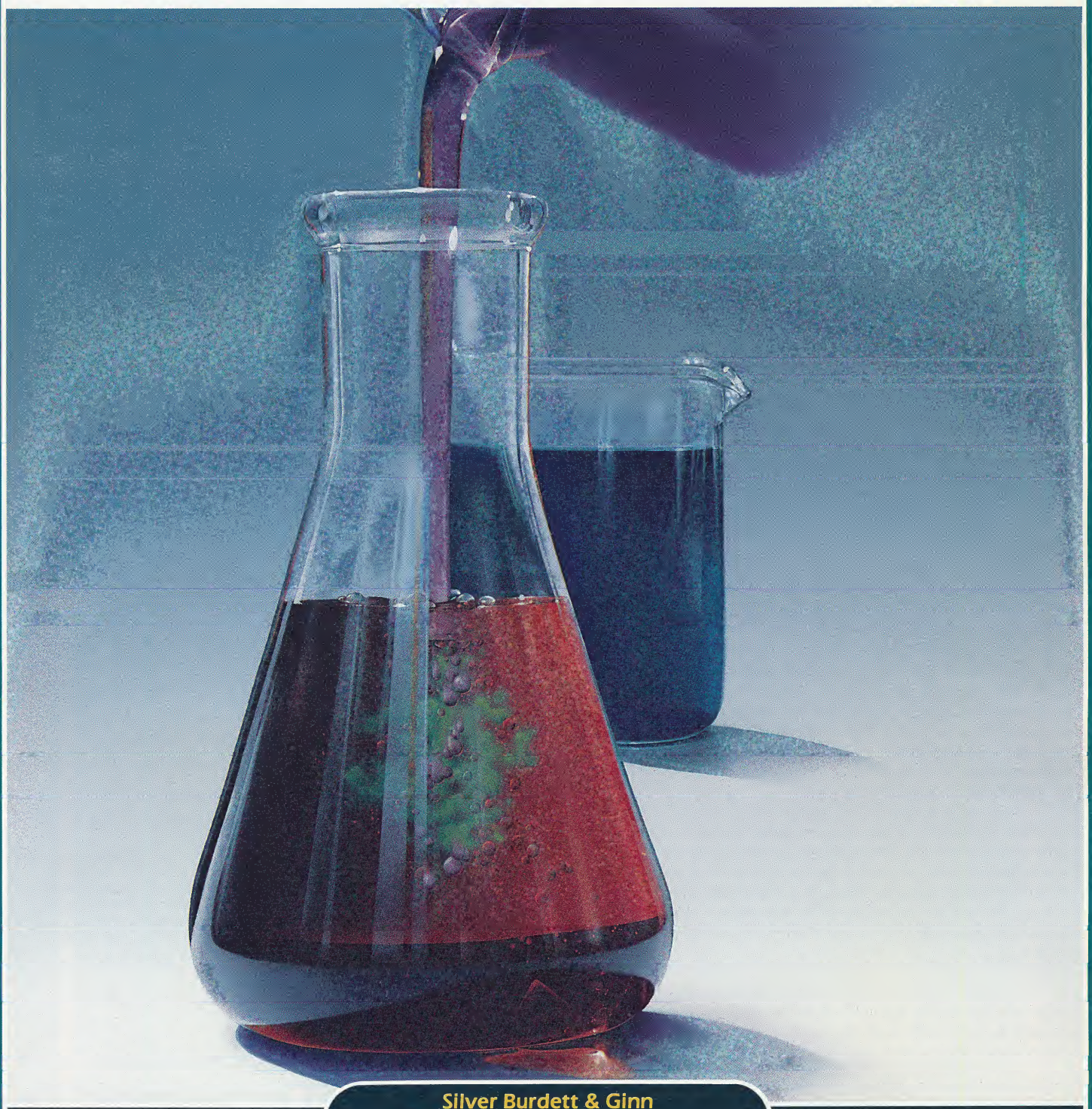
ScienceWorks

Investigating Chemical Reactions



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TO THE TEACHER

Congratulations! You've found the science program that you've been looking for!

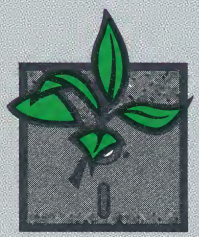
SILVER BURDETT & GINN SCIENCEWORKS provides review and extension of basic science concepts. This courseware can also serve as a valuable tool in introducing science concepts to students with little or no background in this area.

Investigating Chemical Reactions is intended for use with your existing science curriculum. The courseware is directly correlated with the SILVER BURDETT & GINN SCIENCE textbook series, but it is equally applicable to other science texts since it introduces and reinforces science concepts common to most science curricula.

Your students can gain a sense of personal accomplishment by completing the tutorials and activities included in ***Investigating Chemical Reactions***. Each student can work independently at the computer, progressing at his or her own pace. The instruction and HELP screens guide the student through each simulation.

This Courseware Guide provides detailed information about introducing and using ***Investigating Chemical Reactions***. To receive maximum benefit and enjoyment from the program, read the guide carefully.

Food Chains and Food Webs



Investigating Plant Growth

The Human Body: Circulation and Respiration

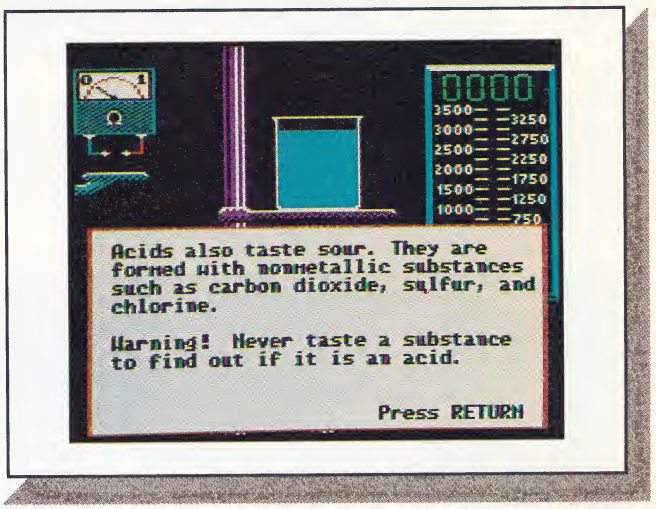
Investigating Chemical Reactions

Climatrolls: A Weather Simulation

Investigating Chemical Reactions is one of a series of SCIENCEWORKS courseware programs supporting SILVER BURDETT & GINN SCIENCE textbooks.

PROGRAM FEATURES

Investigating Chemical Reactions is a courseware simulation program. Students identify unknown substances by conducting scientific experiments while aboard a research vessel. The program is designed to help students understand the fundamentals of chemical reactions. It also reinforces critical scientific skills, including observation, interpretation, and classification. ***Investigating Chemical Reactions*** has the following characteristics and special features.

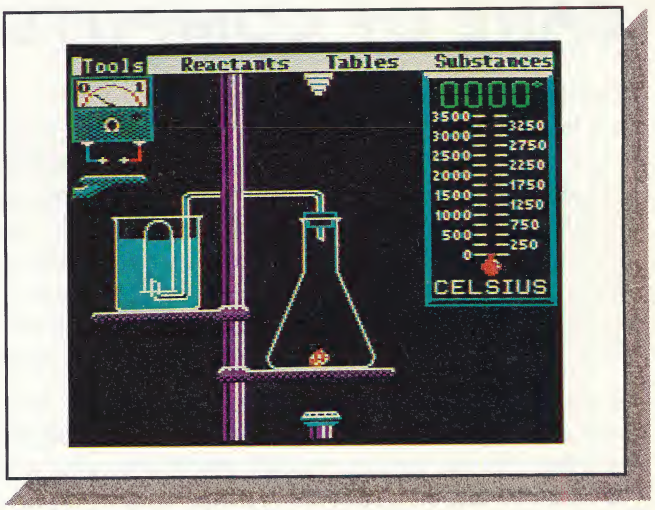


Information module

- Direct correlation with the science activities and skills presented in the SILVER BURDETT & GINN SCIENCE textbook series and with those typically introduced within other fifth- and sixth-grade science curricula
- Opportunity to use the scientific method in observation, data collection, analysis of test results, and evaluation
- Use of the *Portable Lab* independent of the simulation to conduct scientific experiments on known or unknown substances
- Randomization of unknown substances so that students can use the program many times
- Information modules to review concepts
- A careful balance of animation, graphics, and text
- Pacing that is controlled by the student
- Positive reinforcement and feedback in response to student performance
- Clear instructions that most students can follow independently
- HELP screens that provide useful information and guidance
- Fail-safe operation that disables other keyboard options when specific responses are required

DISCOVERY
You have arrived at an uncharted volcanic island with beaches of rare black sand.
Press RETURN to leave the Discovery and explore the island.
Press RETURN

On a *Discovery* Mission



The Portable Lab

CORRELATION WITH SILVER BURDETT & GINN SCIENCE

Investigating Chemical Reactions is correlated with SILVER BURDETT & GINN SCIENCE © 1987 and SILVER BURDETT SCIENCE © 1985, Grades 5 and 6. The disk content correlates with the specific pages shown in the table below.

COMPONENT	SILVER BURDETT & GINN SCIENCE © 1987		SILVER BURDETT SCIENCE © 1985	
	Grade 5 Pages	Grade 6 Pages	Grade 5 Pages	Grade 6 Pages
Pupil Edition	110–131, 132–153 374–375, 376–377	110–131, 132–151 392–393, 394–395	110–131, 132–153 374–375, 376–377	110–131, 132–151 392–393, 394–395
Teacher Edition	109a–109f, 131a–131f 110–131, 132–153 374–375, 376–377	109a–109f, 131a–131f 110–131, 132–151 392–393, 394–395	109a–109b, 131a–131b 110–131, 132–153 374–375, 376–377	109a–109b, 131a–131b 110–131, 132–151 392–393, 394–395
Copy Masters	46–52, 56–62	46–52, 56–62	48–55, 58–65	48–55, 58–65
Workbook	46–54, 55–64	49–57, 58–68	42–49, 50–58	45–52, 53–62

EQUIPMENT NEEDED

To use *Investigating Chemical Reactions* you will need an Apple II Plus (64K including language card), Apple IIe, Apple IIc, or Apple IIGS computer; a color monitor, monochrome monitor, or TV; 1 disk drive. Note: If you are using an Apple IIGS with an RGB monitor, set the processor speed to normal and use a black border.

CARE OF COMPUTERS AND DISKS

You'll want to place your computers where the students using them will not be disturbed and where their use will not distract other students. Place computers away from direct sunlight, chalkboards, sinks, radiators, and heat ducts. To minimize carpet-induced static electricity, which can damage delicate electronic equipment, you can spray carpeting with a commercial antistatic product or a mixture of fabric softener and water. You might also purchase an antistatic mat. Advise your students to touch something metal before beginning to work at the computer. This will release any of the static charges they may be carrying.

It would be advisable to load the disk yourself when the students are first learning to use *Investigating Chemical Reactions*. Then let your students practice loading with a blank disk until you are sure that they can handle disks carefully. You may wish to open a defective disk to show curious students how disks are made.

COMPONENTS

The Disks

One program disk and one duplicate (backup) disk are included in the ***Investigating Chemical Reactions*** courseware package. Each 5¼-inch floppy disk is intended for use with an Apple II Plus (64K including language card), Apple IIe, Apple IIc, or Apple IIGS computer. The program produces colorful graphics when displayed on a color monitor, and it also operates effectively on a monochrome monitor.

The Courseware Guide

Before ***Investigating Chemical Reactions*** is introduced in the classroom, the Courseware Guide should be studied thoroughly. The guide provides information about how the program works, how to integrate it into your science curriculum, and how to extend the concepts presented into other enjoyable science activities.

Copy masters are also included in the Courseware Guide. The copy masters, which include activity sheets designed to complement the courseware, may be reproduced directly or used to make spirit masters for duplication.

TEACHING STRATEGIES AND TIME ALLOTMENTS

The way in which you use ***Investigating Chemical Reactions*** in your classroom depends upon your unique teaching style and the goals you have established for your students. You may wish to follow some of the suggestions below.

- Use the program soon after you have taught concepts in the classroom in order to reinforce them.

  The information modules ''Chemical and Physical Changes,'' ''Acids and Bases,'' and ''Metals and Nonmetals'' can be used individually by students for reinforcement. These interactive tutorials can also be used for class demonstrations. It takes approximately 15 minutes to go through all the modules.

- Use the program to obtain instant results for laboratory work that would take too much valuable class time.

  The Portable Lab can be used to conduct experiments on known or unknown substances. Each experiment can be completed immediately, without actual exposure to possibly dangerous chemicals or situations. This allows extra class time for observation, analysis, and discussion. Time spent at the computer is about 5 minutes for each experiment.

- Use the program to review concepts taught previously.

  The information modules allow students to review characteristics of acids and bases, chemical and physical changes, and metals and nonmetals. The ''Portable Lab Demonstration'' reviews three critical experiments. It takes about 10 minutes to go through this interactive demonstration. It can be done by individuals or small groups of students.

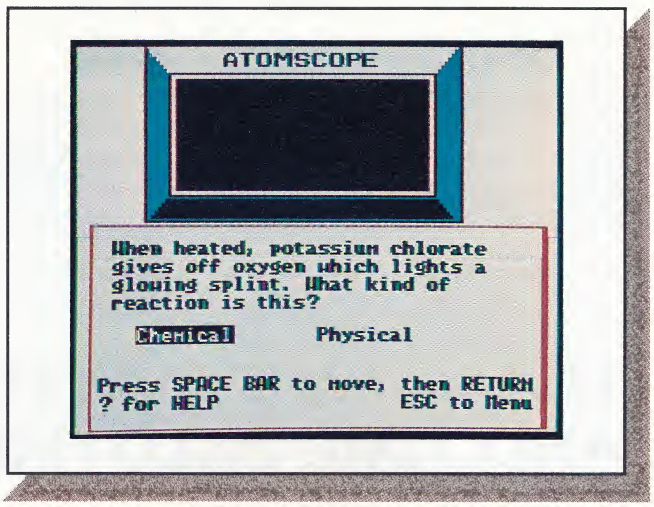
- Use the program to provide help in problem-solving skills related to science concepts.

  The simulation of identifying unknown substances aboard a research vessel allows students to gain skills in observation, interpretation, evaluation, and classification. A simulation takes about 15 to 20 minutes. Decisions made during the simulation affect the outcome of the mission as well as the rank and funding code assigned to the student.

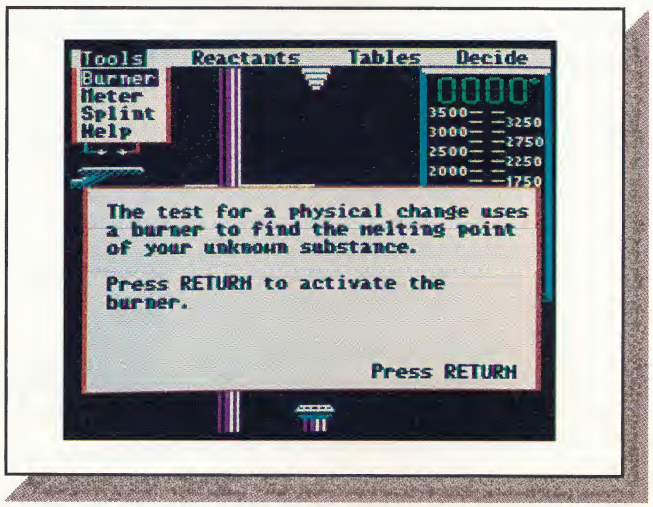
PROGRAM OBJECTIVES

The SCIENCEWORKS series help students review and extend basic science concepts presented in the SILVER BURDETT & GINN SCIENCE textbook series. Upon completion of all sections of ***Investigating Chemical Reactions***, a student should be able to do the following:

- **Describe the use of several scientific experiments conducted in the Portable Lab**
- **Identify the properties of chemical and physical changes, acids and bases, and metals and nonmetals**
- **Use the scientific method in conducting experiments to determine the identity of an unknown substance**
- **Conduct tests and experiments on a known substance in order to verify its identity**
- **Collect data and record the results of experiments on a chart**
- **Interpret and analyze several test results in order to pinpoint the identity of an unknown substance from a list of possible substances**
- **Compare and contrast the properties of identified substances**
- **Recognize the need to conduct additional scientific experiments if an unknown substance can be identified as more than one item**


ATOMSCOPE
When heated, potassium chlorate gives off oxygen which lights a glowing splint. What kind of reaction is this?
Chemical
Physical
Press SPACE BAR to move, then RETURN
? for HELP
ESC to Menu

Identifying type of change



Test for physical change

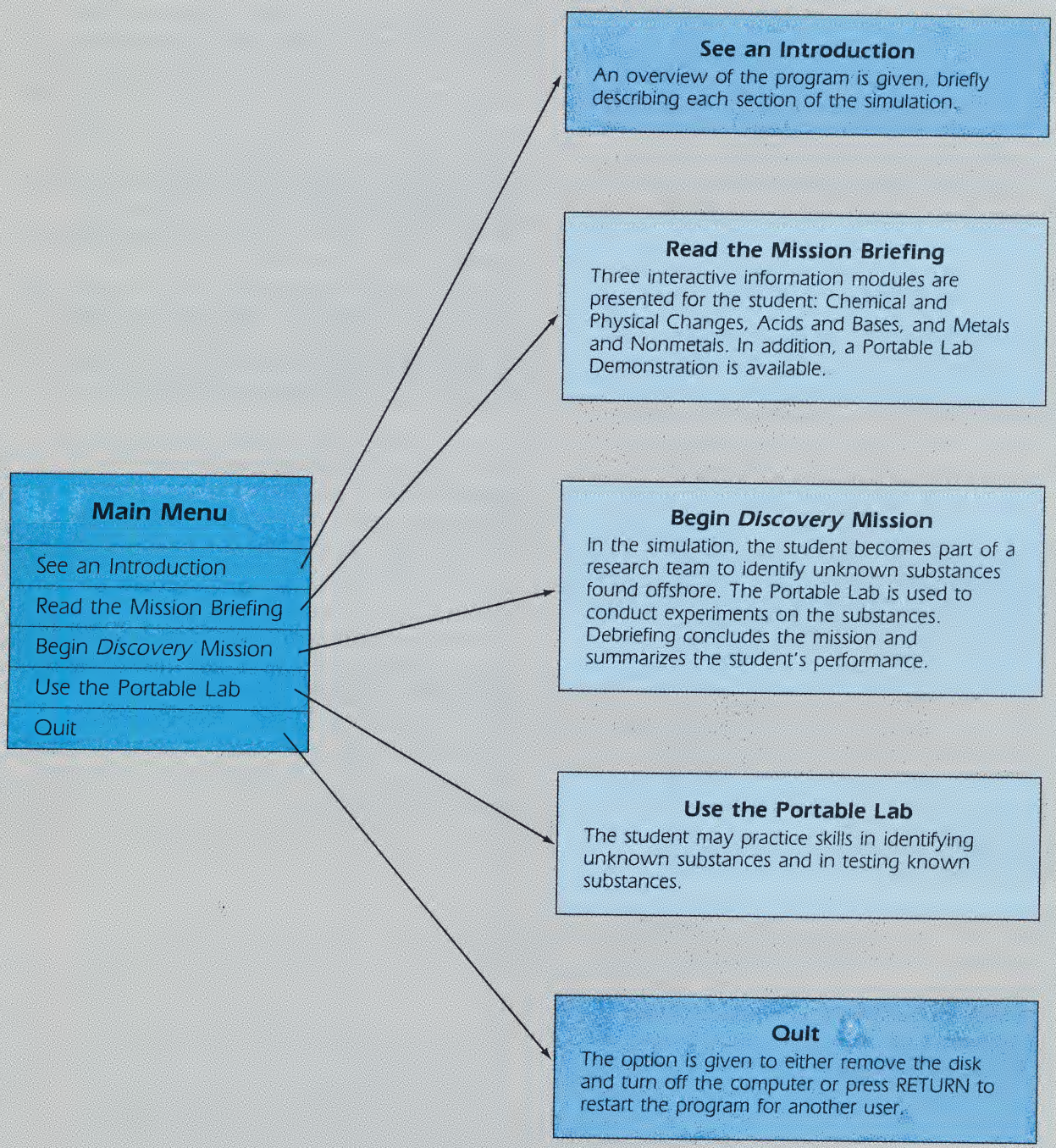
BACKGROUND INFORMATION

Investigating Chemical Reactions is an extension of the chapters on physical and chemical changes in matter in the Physical Science block of the SILVER BURDETT & GINN SCIENCE series, Grades 5 and 6. It can easily be adapted to other science curricula as well. The following background information may be useful.

- There are 18 substances—including metals, nonmetals, and ores—that the student may investigate in the program. All were selected to show how various materials react with primary and special reactants. Eleven of the substances are considered valuable enough to keep aboard the ship: bronze, copper, diamond, gold, iron, lead, manganese, marble, silver, sulfur, and zinc. The other substances—bone, shell, pottery, hematite, chalcopyrite, sphalerite, and carbon—should not be kept when identified.
- Seven different experiments may be conducted in the Portable Lab. Three experiments test for melting point, electrical conductivity, and the presence of hydrogen or carbon dioxide (use of the glowing splint). Four chemical-change-based experiments include the reactants of hydrochloric acid, nitric acid, limewater (used to confirm the presence of carbon dioxide), and ammonium hydroxide (used to confirm the presence of chalcopyrite).
- Each student begins the expedition as a Volunteer with an initial funding of $90,000. The possible ranks and their respective funding codes are Volunteer (VO), Student (ST), Technical Staff Member I (T1), Technical Staff Member II (T2), Scientist (SC), and Chief Scientist (CS). The higher the rank, the greater the amount of funding provided and the longer the mission.
- The Portable Lab can be used to identify an unknown substance or to verify a known substance. For unknown substances, students must complete at least three experiments before deciding the identity of the substance. These include tests for conductivity, physical change (melting point), and at least one experiment based on chemical change.
- In the "Portable Lab Demonstration" and when "Use the Portable Lab" is selected from the Main Menu, the Melting Points table is intended as a reference tool. Therefore, *specific* melting points are listed. However, during the actual simulation, the Melting Points table in the Portable Lab lists *ranges* of melting points so that when students are on a *Discovery* Mission they cannot identify a substance by its melting point alone. Other tests must be conducted before an accurate identification of a substance can be made. Thus students gain experience in using the scientific method to perform tests and collect information as they develop their skills in problem solving.
- In the Portable Lab, a few restrictions apply. The maximum reading on the temperature gauge is 3500° Celsius. In addition, an experiment based on chemical change can involve only one reactant at a time.
- Student performance is summarized in the Debriefing stage of each mission. The student's new rank and funding code are given at this time, based on the correct identification of the unknown substances and whether or not the right decision was made regarding keeping substances aboard the vessel. It is critical that the funding code is recorded before a student leaves the program.

PROGRAM STRUCTURE

This diagram shows the general structure of the ***Investigating Chemical Reactions*** program by indicating where each selection from the Main Menu leads.

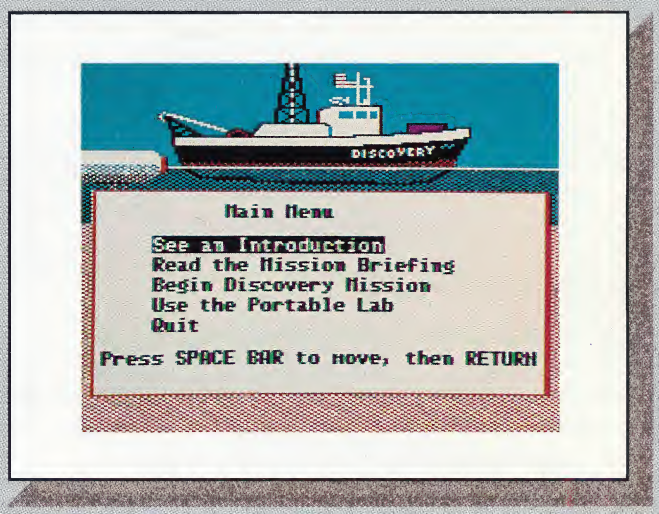

Main Menu
See an Introduction
Read the Mission Briefing
Begin Discovery Mission
Use the Portable Lab
Quit
See an Introduction
An overview of the program is given, briefly describing each section of the simulation.
Read the Mission Briefing
Three interactive information modules are presented for the student: Chemical and Physical Changes, Acids and Bases, and Metals and Nonmetals. In addition, a Portable Lab Demonstration is available.
Begin Discovery Mission
In the simulation, the student becomes part of a research team to identify unknown substances found offshore. The Portable Lab is used to conduct experiments on the substances. Debriefing concludes the mission and summarizes the student's performance.
Use the Portable Lab
The student may practice skills in identifying unknown substances and in testing known substances.
Quit
The option is given to either remove the disk and turn off the computer or press RETURN to restart the program for another user.

PROGRAM DESCRIPTION

The ***Investigating Chemical Reactions*** program contains four major sections: Introduction, Mission Briefing, *Discovery* Mission, and the Portable Lab. Each section is described below.

Introduction

This section welcomes the student and gives an overview of the simulation. This overview includes the following information. As a member of the research team aboard the ship *Discovery*, the student is to look for objects beneath the ocean and on land. Using the Portable Lab and careful analysis procedures, the student is to identify these items. Before the start of the voyage, a Mission Briefing is available to review appropriate scientific topics and give a demonstration of the Portable Lab. The *Discovery* Mission represents the expedition, which lasts from three to eight days. At the end of the mission, a Debriefing summarizes the student's performance and assigns the student's rank and funding code for the next mission.



Main Menu

Mission Briefing

This section of the program contains background information modules for the expedition. There are three information modules: "Chemical and Physical Changes," "Acids and Bases," and "Metals and Nonmetals." A "Portable Lab Demonstration" is available as well as the option to return to the Main Menu.

Chemical and Physical Changes

This information module reviews the characteristics of chemical and physical changes. An animated screen, called an ATOMSCOPE, graphically shows the student how atoms react in chemical or physical changes. At the end of the module, an activity checks student understanding by asking if particular reactions are chemical or physical. The student is told whether the response given is correct or incorrect, and an explanatory sentence follows. During this segment of the program, the student may press "?" for HELP. The HELP screen summarizes five properties for a chemical reaction and two properties for a physical reaction. The activity continues until the student presses the ESC key to return to the Mission Briefing Menu.

Mission Briefing Menu

Acids and Bases

This information module explains the differences between acids and bases. Through animation, hydrochloric acid is combined with a metal. The simulation, accompanied by optional sound for added enjoyment, shows that the metal dissolves and a gas is released. The module further shows that blue litmus paper turns red when dipped into an acid. When red litmus paper is dipped into a base, the paper turns blue. To check understanding, the student is then given several characteristics of specific solutions and is asked to identify each solution as an acid or a base. The student can press "?" for a HELP screen; it displays four characteristics of acids and four characteristics of bases. By pressing the ESC key, the student can return to the Mission Briefing Menu.

Acids and Bases

Metals and Nonmetals

This information module describes the characteristics of metals, nonmetals, and ores. The ohmmeter, with optional sound, is used to show the student that metal is a good electrical conductor. In the interactive tutorial, the student is given a characteristic of a substance and asked to identify it as a metal or a nonmetal. Pressing "?" brings up the HELP screen; it reveals six characteristics of metals and five characteristics of nonmetals. Pressing the ESC key returns the student to the Mission Briefing Menu.

0000
Metals are good conductors of heat and electricity. Copper wiring is used for electricity in homes and offices.
Press RETURN to test a metal with the ohmmeter.

Metals information module

Portable Lab Demonstration

This demonstration shows the student how to conduct three mandatory tests on an unknown substance. The "Conductivity Test" uses an ohmmeter to determine the electrical conductivity of the substance. The "Physical Change Test" uses a temperature gauge and a burner to determine the melting point of the substance. The "Chemical Reactions Test" uses hydrochloric acid to determine if there is a reaction with the substance in the flask. Each animated test, sometimes with optional sound, shows the student how the experiment is performed, its results, and the tables needed for help in identifying the substance. The student is guided to use the scientific method to identify the substance. The results of the tests are analyzed, and the available information tables are used. By the end of the demonstration, the student is familiar with the operation of the Portable Lab.

Portable Lab Demonstration

Discovery Mission

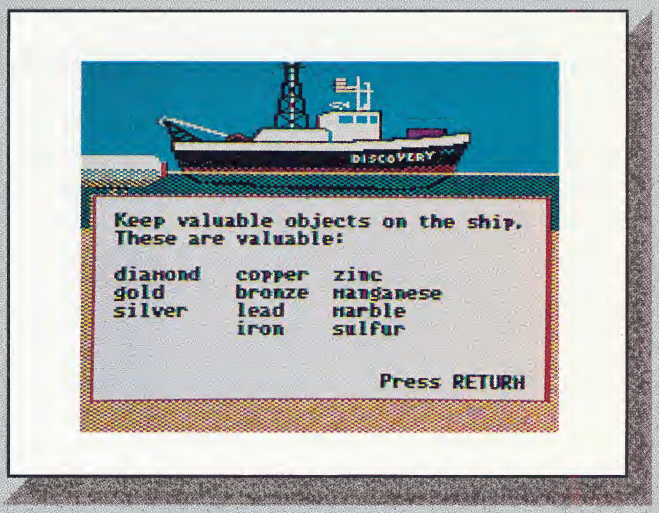
In this section of the program, the student embarks on an expedition aboard the research vessel *Discovery*. The expedition lasts from three to eight days, depending upon the funding level. Each student begins as a Volunteer with funding of $90,000 for a three-day expedition. On the mission, the student locates and attempts to identify valuable substances found beneath the ocean or while walking on a deserted island.

At the start of the mission, the student is given a brief overview. The goal of the simulation is described, and a list of the eleven valuable substances is given. Funding and the three mandatory tests to be conducted in the lab are explained.

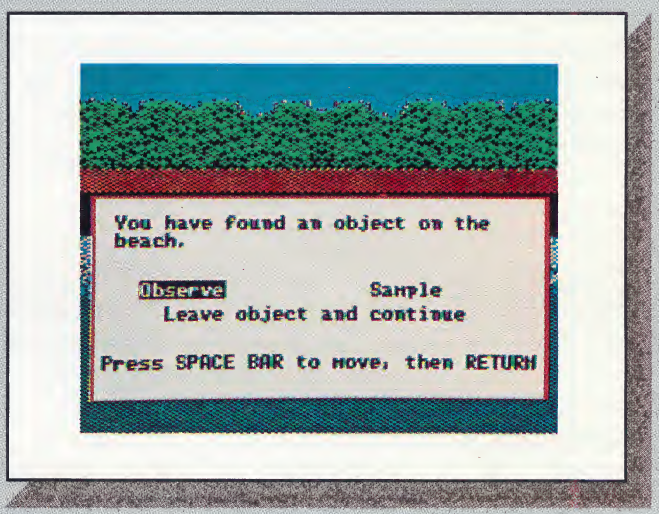
During each day of the mission, at least one object is located. The student is then given three choices: observe, sample, or leave the object and continue. To observe the object, the student is told where it has been found and what its general form seems to be. If the student chooses to sample the substance, a corer, drill, or dredge appears on the screen and a sampling is taken. After being recovered, the substance is transferred to the Portable Lab for further investigation. The student's last choice is to leave the object and continue the expedition in search of another substance.

Once a sample has been taken, the student tries to identify the unknown substance by doing experiments in the Portable Lab. At least three experiments must be completed: melting point, conductivity, and at least one chemical reaction test. Clear instructions guide the student in using the Portable Lab, and several HELP screens are available.

By using the scientific method and carefully analyzing the test results, the student decides when there is enough information to determine the identity of the unknown substance. The tables of conductivity, melting points, and chemical reactions help the student to pinpoint the identity. After identifying the substance, the student must then decide whether or not it should be kept aboard ship. These decisions will affect the summary of the student's performance. The entire procedure is repeated for each day of the mission.



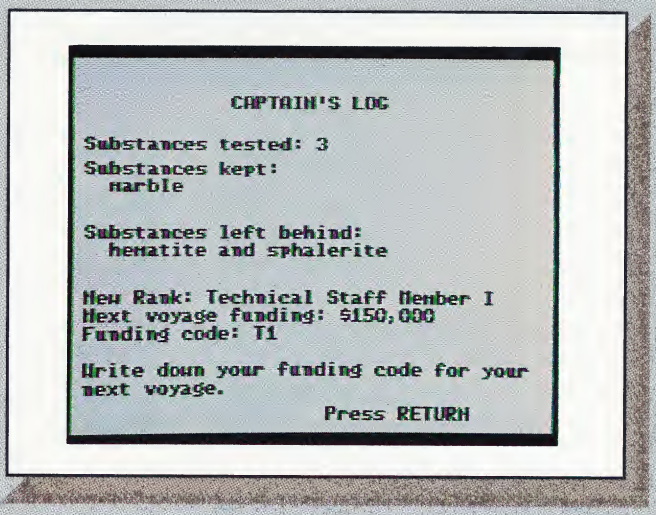
Valuable substances



Choices after finding an object

Observing an object

The Debriefing stage signals the end of the mission. Here the student views the Captain's Log. This is a summary of the experiments attempted, the substances kept aboard ship, the substances left behind, the rank and funding code assigned to the student, and the amount of funding for the next mission. The possible ranks and their respective funding codes are Volunteer (VO), Student (ST), Technical Staff Member I (T1), Technical Staff Member II (T2), Scientist (SC), and Chief Scientist (CS). It is important for the student to record the funding code before leaving the program.



Debriefing stage

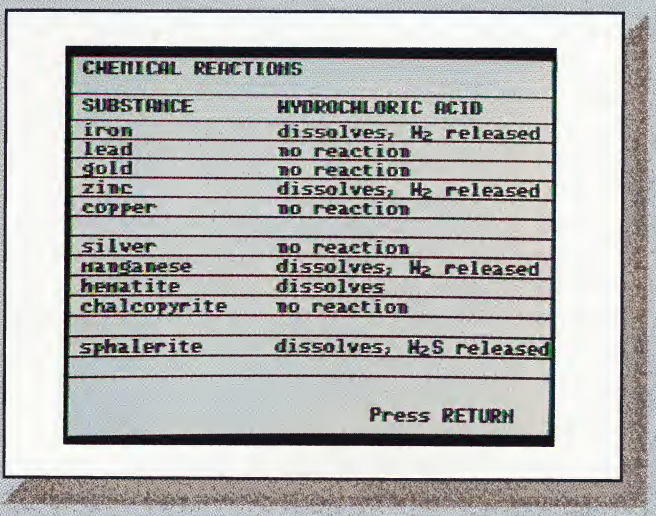
Portable Lab

The Portable Lab can be used in two different ways in the program. It is an integral part of the *Discovery* Mission simulation, and it can also be used independent of the simulation when "Use the Portable Lab" is selected from the Main Menu. Each mode is described below.

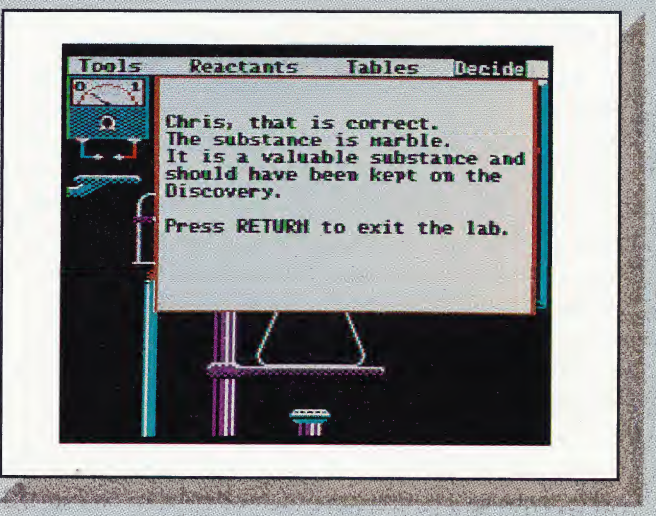
Using the Portable Lab as part of the *Discovery* Mission simulation

In the *Discovery* Mission simulation, the Portable Lab is used to identify an unknown substance while aboard the *Discovery*. This is done by conducting a minimum of three tests: physical change (melting point), conductivity, and at least one chemical reaction test. The Portable Lab has four available options: "Tools," "Reactants," "Tables," and "Decide." All of these options are conveniently listed at the top of the screen.

The "Tools" option offers four choices. The Burner is used to melt the substance in order to find its melting point. The Meter, for ohmmeter, is used to determine the electrical conductivity of the substance. The Splint, for glowing splint, is used to determine the presence of hydrogen or carbon dioxide in the test tube after a "Reactants" test has produced a gas. A HELP screen is the fourth choice; it describes the use of the three tools. The result of each experiment is easily interpreted on the screen.



Chemical Reactions table

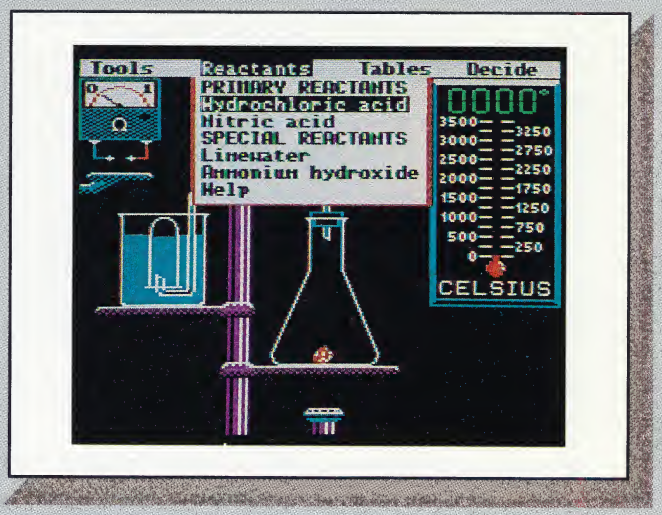

Tools Reactants Tables Decide
Chris, that is correct.
The substance is marble.
It is a valuable substance and should have been kept on the Discovery.
Press RETURN to exit the lab.

Performance feedback

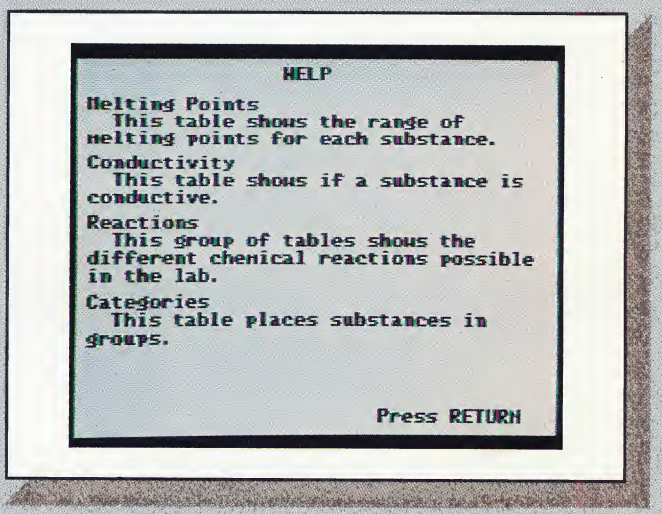
The ''Reactants'' option offers two categories: primary and special reactants. The unknown substance can be combined with the primary reactants of hydrochloric acid or nitric acid. The substance may dissolve, release a gas, produce a blue solution, or may not react at all. If the substance reacts with an acid by producing a gas, the student should immediately use the glowing-splint test to determine if the gas is hydrogen or carbon dioxide. The special reactants available are limewater and ammonium hydroxide. Limewater is used to confirm the presence of carbon dioxide. When carbon dioxide is released from substances such as marble or shell and bubbled through limewater, a white precipitate forms in the limewater solution. Ammonium hydroxide is used to confirm the presence of chalcopyrite. If chalcopyrite is combined with nitric acid and then with ammonium hydroxide, the solution will turn a deeper blue. Also available is a HELP screen that reviews the uses of the primary reactants. The screen also warns of the dangers in using acids in a real lab situation.

The ''Tables'' option includes tables for melting point ranges, electrical conductivity, chemical reaction with hydrocholoric or nitric acid, and a category listing. The ''Melting Points'' table for this segment displays ranges rather than specific melting points. Therefore, while on the *Discovery* Mission the student cannot identify a substance by its melting point alone. Other tests must be conducted before an accurate identification of a substance can be made. The ''Categories'' table lists each substance under the appropriate heading of ''Metals,'' ''Nonmetals,'' ''Ores,'' or ''Other Deposits.'' The HELP screen in this section of the program displays a brief description of each table.

The ''Decide'' option enables the student to establish the identity of the unknown substance. If the three specific tests have not been conducted, the student must continue to experiment in the Portable Lab. When the Portable Lab is used in the simulation, the student decides at this point whether or not the object should be kept aboard ship. This decision affects student performance, which is summarized in the Captain's Log in the Debriefing stage.



Using the Portable Lab


HELP
Melting Points
This table shows the range of melting points for each substance.
Conductivity
This table shows if a substance is conductive.
Reactions
This group of tables shows the different chemical reactions possible in the lab.
Categories
This table places substances in groups.
Press RETURN

HELP screen describing tables

Making a decision

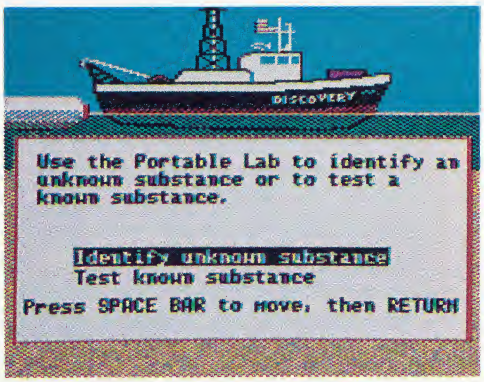
Using the Portable Lab independent of the *Discovery* Mission simulation

A unique feature of the program is that the Portable Lab may be used independent of the simulation. When "Use the Portable Lab" is selected from the Main Menu, the student can practice skills in identifying an unknown substance or in testing a known substance. In identifying an unknown substance, the student conducts the experiments just as they are done in the simulation. The student learns whether the identification is correct, and whether or not the substance should be kept aboard ship.

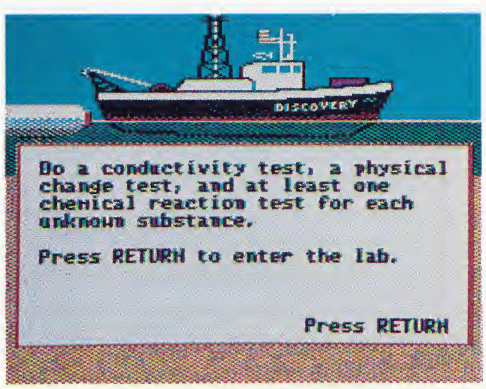
To test a known substance, the student chooses the substance and can conduct any of the experiments available in the Portable Lab on the *Discovery* Mission simulation. Four options available are "Tools," "Reactants," "Tables," and "Substances." The first two options are identical to those described above. However, when the Portable Lab is used independent of the *Discovery* Mission simulation, its use is intended as a reference tool. Therefore, *specific* melting points rather than ranges are given in the Melting Points table. Also, when "Use the Portable Lab" is selected from the Main Menu, "Substances" replaces the "Decide" option. Choosing the "Substances" option allows the student to select another substance for testing.

The "Use the Portable Lab" section of the program is especially beneficial in the classroom. The result of each test on a substance can be recorded on a Portable Lab Record Sheet (copy master on page 28). This information can then be used by the student in the *Discovery* Mission simulation.

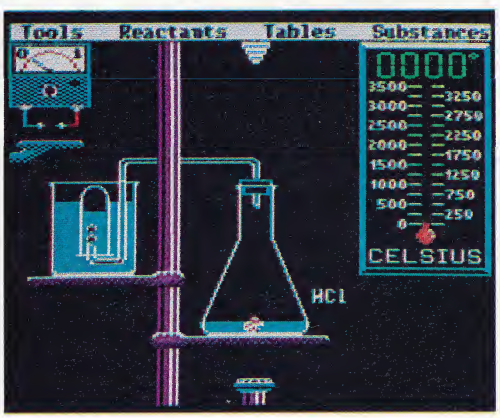
The student is encouraged to employ the scientific method whether the Portable Lab is used as part of the simulation or independent of it. When using the Portable Lab to identify unknown substances, the student can formulate and verify hypotheses. Experiments are conducted immediately for the student to observe and record results. Analysis and evaluation of this data helps the student to correctly identify the various substances.


DISCOVERY
Use the Portable Lab to identify an unknown substance or to test a known substance.
Identify unknown substance
Test known substance
Press SPACE BAR to move, then RETURN

Choices for using the Portable Lab


DISCOVERY
Do a conductivity test, a physical change test, and at least one chemical reaction test for each unknown substance.
Press RETURN to enter the lab.
Press RETURN

Tests to be performed in the Portable Lab

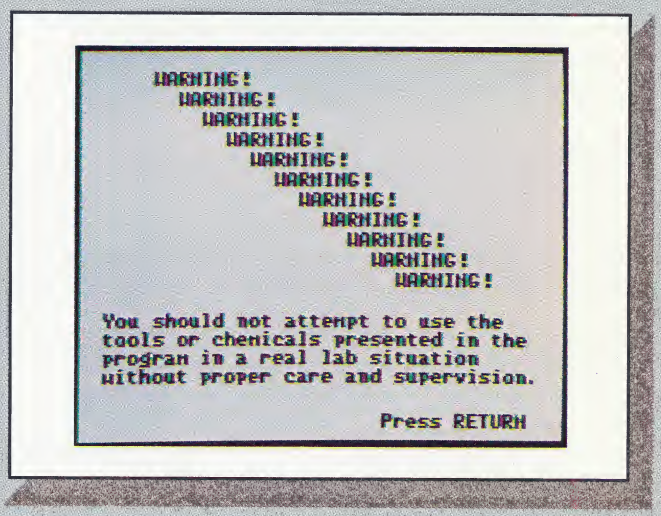


Reaction test in the Portable Lab

TRIAL SIMULATION

The *Discovery* Mission simulation in ***Investigating Chemical Reactions*** gives students a simulated scientific adventure aboard the research vessel *Discovery*. To help students receive the maximum benefit and enjoyment from the program, you may want to present a complete demonstration of how the simulation works. The instructions given below provide for a trial simulation that requires about 30 minutes.

(1) Turn on the monitor, insert the disk, and turn on the computer. A few introductory screens will appear. A WARNING screen cautions the student not to conduct the experiments used in the simulation in a real lab situation without proper care and supervision. Press RETURN.



WARNING screen

(2) Enter your name and press RETURN. For this demonstration, there are no previous funds; press "N" for "no." For the next screen, press "Y" for "yes" to obtain sound.

(3) The Main Menu appears. Show students how to select an option by pressing the SPACE BAR. Note that the box highlights each choice in order as the SPACE BAR is pressed. Continue to press the SPACE BAR until the box highlights "See an Introduction." Then press RETURN. Emphasize to the students that this same procedure is used to make selections throughout the program.

(4) "See an Introduction" gives an overview of the simulation and explains the Briefing, Mission, and Debriefing stages. Read the text on each screen aloud. When the Main Menu reappears, select "Read the Mission Briefing." This offers several tutorials that provide background information for the expedition.

DISCOVERY
Welcome to Investigating Chemical Reactions, Chris.
The Discovery is a research ship used to explore the ocean. As a member of the ship's research team, you will look for valuable substances.
Press RETURN

Introduction screen

(5) The Mission Briefing menu appears. Familiarize students with all choices. To illustrate one option, select "Chemical and Physical Changes" and press RETURN.

(6) The differences between chemical and physical changes are explained. The ATOMSCOPE shows how atoms react during the various changes. After each tutorial or information module, a series of questions are asked. Read each question aloud; have the class decide if the reaction is chemical or physical. An explanation of the correct answer follows each question. Press "?" to show students how to receive help in answering the questions. Do several exercises. Press the ESC key to return to the Mission Briefing Menu.

(7) The Mission Briefing menu reappears. Explain to the students that the next two choices similarly review the characteristics of "Acids and Bases" and "Metals and Nonmetals." These program sections can be used individually at a later time. Familiarize students with the workings of the Portable Lab by selecting "Portable Lab Demonstration." Press RETURN.

(8) This demonstration reviews the three mandatory tests of the Portable Lab: conductivity, melting points, and the chemical reaction test with hydrochloric acid. It also shows students how the Portable Lab options are selected.

(9) At the end of this demonstration, the Mission Briefing menu reappears. Select "Return to the Main Menu" and press RETURN.

(10) You are now ready to start the expedition. Select "Begin Discovery Mission."

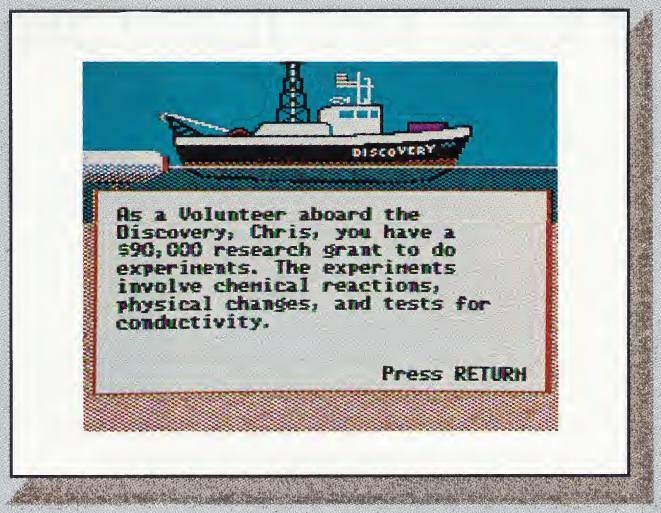
(11) The initial screens describe the adventure and its goals. Read each screen aloud. Answer any questions the students may have.

(12) The three-day mission now begins. Watch the animation of the ship as it searches for an object. When an object is located, select "Observe." Read the observation and press RETURN. Then select "Sample." A corer, drill, or dredge will appear on the screen to take a sampling of the object. Pressing RETURN transfers the sample to the Portable Lab.

(13) In the Portable Lab, select "Tools." Then select "Burner." After pressing RETURN, the burner is activated, and the temperature gauge displays the melting point of the substance. On a copy of the Daily Record Sheet for a *Discovery* Mission (copy master on page 27), record the melting point if there is one.

(14) To conduct the second experiment, select "Tools" and then "Meter." This uses the ohmmeter for the conductivity test. It shows if the substance is conductive. Be sure to record this test result on the Daily Record Sheet for a *Discovery* Mission.

(15) To encourage use of the scientific method, have students predict one or more identities for the substance. Begin by selecting "Tables" and then "Melting Points." Help students interpret the table. Then select "Tables" and Conductivity." This table may help to narrow the number of choices.


DISCOVERY
As a Volunteer aboard the Discovery, Chris, you have a $90,000 research grant to do experiments. The experiments involve chemical reactions, physical changes, and tests for conductivity.
Press RETURN

Beginning the Mission

DISCOVERY
A sample has been recovered from the ocean floor.
Press RETURN to place the sample in the Portable Lab.
Press RETURN

Taking a sample

Experimenting in the Portable Lab

(16) To conduct the third test, select "Reactants" and then "Hydrochloric acid." Tell students to watch as the acid is poured into the flask containing the substance. The substance may dissolve, a gas may be released, or there may be no reaction at all. If a gas is released, then immediately select "Splint" under "Tools" to determine whether the gas is hydrogen (H_2) or carbon dioxide (Co_2). The Help option in the "Tools" section explains the results of the glowing-splint test. Record the result on the Daily Record Sheet for a *Discovery* Mission.

(17) Guide the students to find the correct identity of the substance. If more information is needed, conduct other tests in the same way. Other tests are for reactions with nitric acid, limewater, and ammonium hydroxide. Stress the importance of recording each test result.

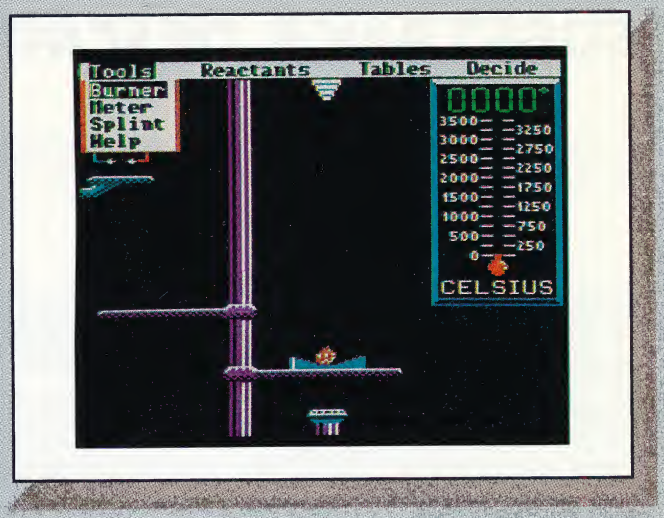
(18) When an identity has been decided upon, select "Decide" and then select the appropriate name. After pressing RETURN, students must also decide whether or not the substance is to be kept aboard ship. This decision seriously affects the performance rating for the mission; not keeping a *valuable* substance will have an effect on the rank assigned at the end of the mission. Press RETURN.

(19) A screen appears that indicates if the decisions made were correct or incorrect. The true identity of the substance is given as well as information about whether or not the substance is valuable and should have been kept.

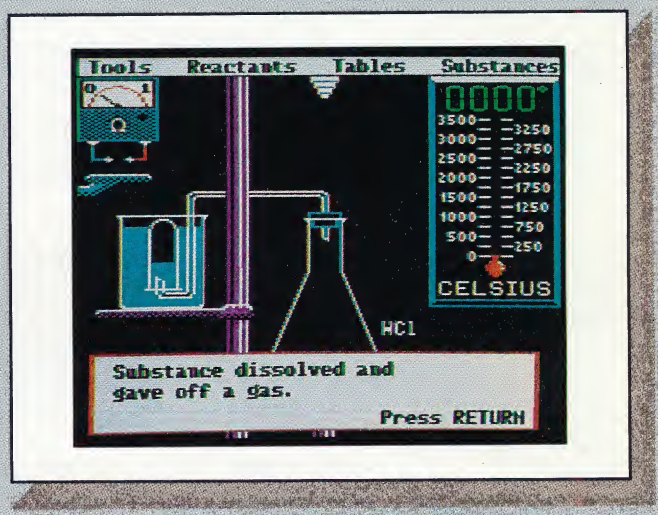
(20) The remaining days of the mission proceed in the same manner. Sometimes an object is located on a deserted island. Conduct the experiments and urge students to use the scientific method. When the last substance has been identified, the Debriefing stage occurs.

(21) The Captain's Log summarizes the students' performance on this trial expedition. This screen shows the rank, funding level, and funding code achieved. Emphasize the importance of recording the funding code so that it can be used for the next voyage.

(22) Pressing RETURN restores the Main Menu. Selecting "Quit" ends the demonstration.



Selecting a tool



Test result

Deciding if an object is valuable

SUBSTANCE DESCRIPTIONS

A brief description of each of the 18 substances that can be identified in ***Investigating Chemical Reaction*** is given below.

Substance	Description
bone	A rigid supporting tissue for the skeletons of vertebrates, consisting of inorganic salts combined with calcium carbonate
bronze	An alloy of copper and tin used in tools, electrical hardware, and cosmetics
carbon	A nonmetallic element found in all organic and a few inorganic compounds
chalcopyrite	A sulfide of copper and iron that is the most important ore of copper
copper	A yellowish-red metal commonly used in wiring
diamond	A form of carbon characterized by its brilliance and hardness
gold	A yellow metal used in jewelry and coins
hematite	A common reddish-brown mineral containing iron, used in paints and polishing compounds
iron	A silver-white metal used to make automobile parts, magnets, and other metallurgy products
lead	A gray metal that is soft and malleable; used in pipes, batteries, and shields against radioactivity
manganese	A silver-white metal used in steel manufacturing
marble	A form of calcium carbonate sometimes used as a source of carbon dioxide in experiments
pottery	An item made from clay that is shaped while it is moist and soft, then hardened by heat
shell	A hard external covering secreted by the body walls of many animals
silver	A white metal used in jewelry and in bearings for aircraft engines
sphalerite	A brittle mineral containing zinc
sulfur	A yellowish nonmetal substance used in soil conditioners, explosives, and insecticides
zinc	A bluish-white metal widely used as a protective coating for iron and steel

PORTABLE LAB TABLES

As a convenience to you, the teacher, the information provided in the Portable Lab tables in ***Investigating Chemical Reactions*** is given below. The substances are listed in the order in which they appear in the tables on the disk. Each student should use a copy of the Portable Lab Record Sheet (copy master on page 28) to enter the results of his or her findings while using ***Investigating Chemical Reactions***.

Substance	Melting Points °Celsius	Conductivity	Chemical Reactions		Category
			Hydrochloric Acid	Nitric Acid	
iron	1535 (above 1500)*	yes	dissolves; H_2 released	dissolves	metal
lead	328 (below 900)*	yes	no reaction	dissolves	metal
gold	1064 (900-1200)*	yes	no reaction	no reaction	metal
zinc	420 (below 900)*	yes	dissolves; H_2 released	dissolves	metal
copper	1083 (900-1200)*	yes	no reaction	dissolves; forms blue solution	metal
silver	962 (900-1200)*	yes	no reaction	dissolves	metal
manganese	1244 (1200-1500)*	yes	dissolves; H_2 released	dissolves	metal
hematite	no melting point	no	dissolves	dissolves	ore
chalcopyrite	no melting point	no	no reaction	dissolves; forms blue solution	ore
sphalerite	no melting point	no	dissolves; H_2S released	dissolves	ore
sulfur	119 (below 900)*	no	no reaction	no reaction	nonmetal
marble	no melting point	no	dissolves; CO_2 released	dissolves; CO_2 released	other deposit
carbon	no melting point; makes small flares	no	no reaction	no reaction	nonmetal
pottery	no melting point	no	no reaction	no reaction	other deposit
bronze	1205 (1200-1500)*	yes	no reaction	dissolves; forms blue solution	metal
shell	no melting point; decomposes when heated	no	dissolves; CO_2 released	dissolves; CO_2 released	other deposit
diamond	3500 (above 1500)*	no	no reaction	no reaction	nonmetal
bone	no melting point; decomposes when heated	no	dissolves	dissolves	other deposit

* In the "Portable Lab Demonstration" and when "Use the Portable Lab" is selected from the Main Menu, *specific* melting points are given in the Melting Points table. When the Portable Lab is used during the *Discovery* Mission simulation, *ranges* are given rather than the specific melting point. Where applicable in the above table, these ranges are shown in parentheses.

EXTENDING ACTIVITIES

The following activities may be used to extend student understanding of the concepts and processes found in ***Investigating Chemical Reactions.*** Stress that whether conducting an experiment in class or at home, all students should wear safety equipment and be supervised by an adult.

- Have students test for conductivity using a battery. The following materials are needed.

  4.5-volt battery
  miniature bulb holder
  small screwdriver
  3.5-volt bulb
  3 pieces of bell wire
  several metals and nonmetals to test

  (1) Attach a piece of wire to each of the battery terminals. Wind one of these two wires around one of the screws on the bulb holder. Put the third piece of wire around the other screw on the bulb holder.

  (2) Holding the loose ends of the two wires together makes the bulb light. This shows that an electrical current is flowing.

  (3) Hold an object to test between the two loose wires. Press the wires firmly to the object. If the object conducts current, the bulb lights. Test each object and record the results.

- Have students investigate the reaction of a metal. The following materials are needed.

  5 test tubes and 4 corks
  steel wool
  tap water and boiled water
  table salt
  calcium chloride

  (1) Put a small piece of steel wool in the bottom of each test tube. Add tap water to the first tube, boiled water to the second, tap water and salt to the third, and calcium chloride to the fourth. Do not add anything to the last tube.

  (2) Cork and label the first four test tubes.

  (3) Observe results after a few days.

- Have students research the causes and possible preventions of rust. Collect pictures of rusted items and have students write a paragraph on how the rust might have been prevented. Their investigation can also include the process of galvanization and its uses.

- To demonstrate a chemical change, have students make glue. The following materials are needed.

glass pan	jar and strainer
skim milk	sodium bicarbonate
hot plate	water
tablespoon	measuring cup
vinegar	teaspoon

  (1) To the glass pan, add a pint of skim milk and six tablespoons of vinegar. Heat slowly, stirring constantly. Remove the pan from the heat when the milk begins to curdle. Continue to stir until the curdling stops.

  (2) Pour this mixture into the strainer over the jar. Allow the curds to dry.

  (3) Add one-fourth cup of water and a teaspoon of sodium bicarbonate to the dried curds. Stir. Fine bubbles appear as the chemical change takes place and causes the mixture to turn to glue.

  (4) Test the glue by using it to paste together two pieces of paper. Let the glued pieces of paper dry thoroughly and then try to pull them apart.

- Create a bulletin board of food labels from products that contain metals or metallic compounds. Have groups of students research the metals listed and compare them to those metals listed on a vitamin and mineral label. Have students report the uses of these metals that help the human body.

- Have students keep a log of the examples of chemical and physical changes they observe in any 24-hour period. Offer a small prize to the student who has observed the greatest number of such changes.

- Have groups of students research acid rain. Have them include its causes and its effects on our environment.

- Invite a scientist to class to speak on the various tools and equipment used aboard research vessels. Have students draw pictures of this equipment to post on a bulletin board.

RESOURCE MATERIALS

Computer Courseware

SILVER BURDETT & GINN SCIENCE 5 Vocabulary Disk for Grade 5, Chapter 5, "Building Blocks of Matter," for use with ***Spellagraph***™, ***Spellakazam***™, or ***Planet of Lleps***™.

SILVER BURDETT & GINN SCIENCE 5 Vocabulary Disk for Grade 5, Chapter 6, "Physical Changes in Matter," for use with ***Spellagraph***™, ***Spellakazam***™, or ***Planet of Lleps***™.

SILVER BURDETT & GINN SCIENCE 6 Vocabulary Disk for Grade 6, Chapter 5, "Matter and Atoms," for use with ***Spellagraph***™, ***Spellakazam***™, or ***Planet of Lleps***™.

SILVER BURDETT & GINN SCIENCE 6 Vocabulary Disk for Grade 6, Chapter 6, "Chemical Changes in Matter," for use with ***Spellagraph***™, ***Spellakazam***™, or ***Planet of Lleps***™.

Sound Filmstrips

Building Blocks of Matter. Morristown, N.J.: Silver Burdett & Ginn, 1987. 100 frames, color; cassette.

Chemical Changes in Matter. Morristown, N.J.: Silver Burdett & Ginn, 1987. 100 frames, color; cassette.

Matter and Atoms. Morristown, N.J.: Silver Burdett & Ginn, 1987. 100 frames, color; cassette.

Physical Changes in Matter. Morristown, N.J.: Silver Burdett & Ginn, 1987. 100 frames, color; cassette.

Books for Students

Asimov, Isaac. *How Did We Find Out About Atoms?* New York: Walker and Co., 1976. ISBN 0-8027-6248-4

Bronowski, Jacob, and Millicent E. Selsam. *Biography of an Atom*. New York: Harper and Row, Publishers, Inc., 1965. ISBN 0-06-020641-1

Challand, Helen. *Activities in the Physical Sciences*. Chicago, Ill.: Children's Press, 1984. ISBN 0-516-00504-9

Chisholm, Jane, and Mary Johnson. *Introduction to Chemistry*. Tulsa, Oklahoma: EDC Publishing, 1983. ISNB 0-86020-710-2

Cobb, Vicki. *Chemically Active! Experiments You Can Do at Home*. New York: Lippincott Junior Books, 1985. ISBN 0-397-32080-9

———. *More Science Experiments You Can Eat*. New York: Lippincott Junior Books, 1979. ISBN 0-397-31878-2

Gardner, Robert. *Kitchen Chemistry: Science Experiments to Do at Home*. New York: Julian Messner, 1982. ISBN 0-671-42102-6

Herbert, Don. *Mr. Wizard's Experiments for Young Scientists*. New York: Doubleday & Co., 1959. ISBN 0-385-07798-X

Johnson, Mary. *Chemistry Experiments*. Tulsa, Oklahoma: EDC Publishing, 1983. ISBN 0-88110-161-3

Keller, Mollie. *Marie Curie*. Danbury, Conn.: Franklin Watts, Inc., 1982. ISBN 0-531-04476-9

Lampton, Christopher. *Fusion, The Eternal Flame*. Danbury, Conn.: Franklin Watts, Inc., 1982. ISBN 0-531-04485-8

Medoff, Sol, and John Powers. *The Student Chemist Explores Atoms and Molecules*. New York: Richard Rosen Press, Inc., 1977. ISBN 0-8239-0381-8

St. George, Judith. *The Brooklyn Bridge: They Said It Couldn't Be Built*. New York: G.P. Putnam's Sons, 1982. ISBN 0-399-20873-9

Zubrowski, Bernie. *Messing Around with Baking Chemistry: A Children's Museum Activity Book*. Boston: Little, Brown & Co., 1981. ISBN 0-316-98879-0

COPY MASTERS

The following pages (25–32) contain copy masters to be used with ***Investigating Chemical Reactions***. The descriptions below include suggestions for using the copy masters.

Vocabulary Crossword Puzzle

This copy master provides a crossword puzzle containing words related to concepts and processes found in ***Investigating Chemical Reactions***. It is recommended that students be given this crossword puzzle after they have used the program. The answer key for this copy master appears on page 29.

Properties of Matter

This copy master asks students to show whether statements related to properties of matter are "true" or "false" and to write the letters shown beside their answers in the corresponding numbered boxes at the bottom of the page. If the task is completed correctly, the letters in the boxes will spell a science term. It is recommended that this copy master be given to students after they have used ***Investigating Chemical Reactions***. The answer key for this copy master appears on page 29.

Daily Record Sheet for a *Discovery* Mission

If students are given a copy of the Daily Record Sheet for a *Discovery* Mission before each session at the computer, they can record their test results while working through each day of the mission. The practice of keeping orderly records helps students develop good working habits. It also encourages students to use the scientific method in formulating hypotheses and verifying them with additional testing. When substances have been correctly identified, relevant test results can be transferred to the Portable Lab Record Sheet.

Portable Lab Record Sheet

This copy master provides a chart with a list of the substances that can be identified in the program. The substances are listed in the order in which they appear in the tables on the disk. Students can use this record sheet to record the results of tests conducted in the Portable Lab. As students add information to the chart, they will be able to compare and contrast test results for the various substances. When completed, this record sheet can be used as an aid in identifying unknown substances found during a mission. They answer key for this copy master appears on page 29.

Loading Disks / Keyboard Guide

A copy of this information may be posted near the computer to provide students with instructions for loading disks and easy reference to special keys used in the program.

Care of Disks

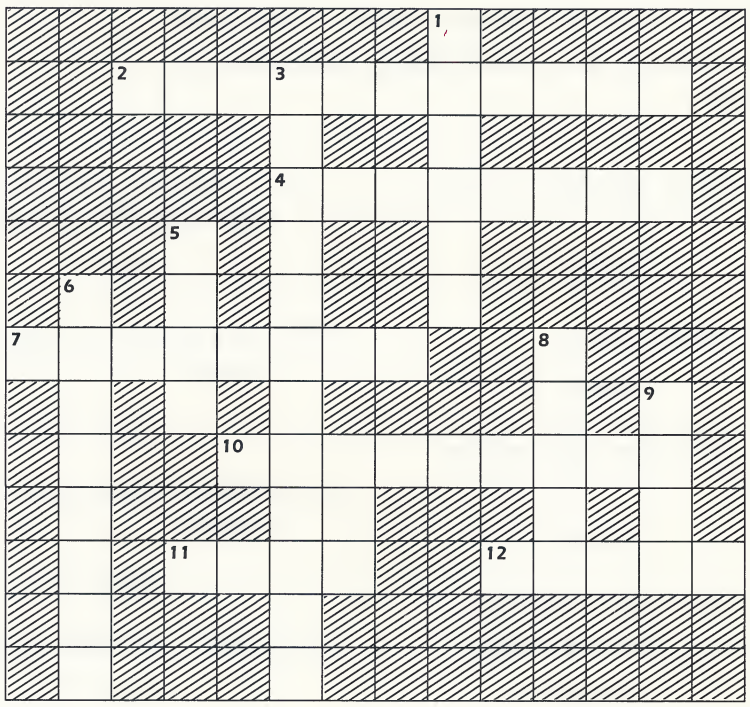
This copy master graphically presents the guidelines for disk care and handling. You may want to post a copy near the computer and give a copy to each of your students.

Quick Start

This copy master provides abbreviated and graphic loading instructions for the Apple computer. These directions may be reproduced and posted near the computer as a ready reference for students.

NAME _____

Vocabulary Crossword Puzzle



Across

2. A solid that forms and separates from a solution

4. A substance that is a poor conductor of electricity

7. A change in the size, shape, or state of matter

10. Used to determine the presence of carbon dioxide in a substance

11. A substance that contains hydrogen

12. A container used to mix one substance with another

Down

1. A type of paper used to determine if a substance is an acid or a base

3. A test that determines if a substance is a good conductor of electricity

5. A substance made up of oxygen and hydrogen joined by a metal

6. An instrument used to measure electrical resistance

8. A substance that is a good conductor of electricity

9. The rocks or minerals from which useful metals can be obtained

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Properties of Matter

Circle "True" or "False" for each statement below. Then write the letter beside your answer in the corresponding numbered box at the bottom of the page.

1. A chemical reaction may produce a white precipitate.

True: S False: T

2. Most metals have a shiny luster.

True: C False: H

3. An ohmmeter is used to find the melting point of a substance.

True: A False: I

4. The heating of paraffin wax to become a liquid is an example of physical change.

True: E False: P

5. The dissolving of table salt in water is an example of a physical change.

True: N False: E

6. Nonmetals can be solids, liquids, or gases.

True: T False: N

7. Metals can have several different colors.

True: O False: I

8. Metals are usually solid at room temperature.

True: F False: Y

9. A chemical reaction may produce an explosion or a fizzing noise.

True: I False: E

10. An example of a physical change is iron rusting.

True: B False: C

11. Baking bread is an example of physical change.

True: A False: M

12. Metals can take on many different shapes.

True: E False: G

13. Metals are good conductors of electricity.

True: T False: L

14. An ore is a mineral compound containing useful metals.

True: H False: M

15. Evaporation and condensation are examples of chemical changes.

True: Y False: O

16. When a physical change occurs, new substances are formed.

True: S False: D

1	2	3	4	5	6	7	8	9	10

11	12	13	14	15	16

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NAME _____

Daily Record Sheet for a *Discovery* Mission

Day	Melting Point °Celsius	Conduc-tivity Y/N	Hydrochloric Acid Reaction	Nitric Acid Reaction	Results of Other Tests	Possible Substances	Identity of Substance	Valuable Y/N

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NAME _____

Portable Lab Record Sheet

Substance	Melting Point °Celsius	Conduc-tivity Y/N	Hydrochloric Acid Reaction	Nitric Acid Reaction	Results of Other Tests
iron					
lead					
gold					
zinc					
copper					
silver					
manganese					
hematite					
chalcopyrite					
sphalerite					
sulfur					
marble					
carbon					
pottery					
bronze					
shell					
diamond					
bone					

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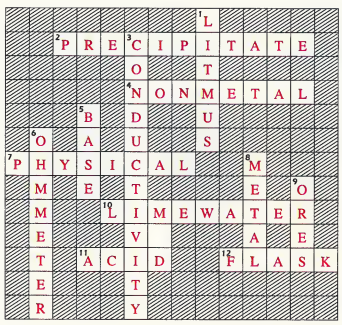
ANSWER KEY

NAME _____

Vocabulary Crossword Puzzle



Across

2. A solid that forms and separates from a solution
4. A substance that is a poor conductor of electricity
7. A change in the size, shape, or state of matter
10. Used to determine the presence of carbon dioxide in a substance
11. A substance that contains hydrogen
12. A container used to mix one substance with another

Down

1. A type of paper used to determine if a substance is an acid or a base
3. A test that determines if a substance is a good conductor of electricity
5. A substance made up of oxygen and hydrogen joined by a metal
6. An instrument used to measure electrical resistance
8. A substance that is a good conductor of electricity
9. The rocks or minerals from which useful metals can be obtained

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NAME _____

Properties of Matter

Circle "True" or "False" for each statement below. Then write the letter beside your answer in the corresponding numbered box at the bottom of the page.

1. A chemical reaction may produce a white precipitate.
   (True: S) False: T
2. Most metals have a shiny luster.
   (True: C) False: H
3. An ohmmeter is used to find the melting point of a substance.
   True: A (False: I)
4. The heating of paraffin wax to become a liquid is an example of physical change.
   (True: E) False: P
5. The dissolving of table salt in water is an example of a physical change.
   (True: N) False: E
6. Nonmetals can be solids, liquids, or gases.
   (True: T) False: N
7. Metals can have several different colors.
   True: O (False: I)
8. Metals are usually solid at room temperature.
   (True: F) False: Y
9. A chemical reaction may produce an explosion or a fizzing noise.
   (True: I) False: E
10. An example of a physical change is iron rusting.
    True: B (False: C)
11. Baking bread is an example of physical change.
    True: A (False: M)
12. Metals can take on many different shapes.
    (True: E) False: G
13. Metals are good conductors of electricity.
    (True: T) False: L
14. An ore is a mineral compound containing useful metals.
    (True: H) False: M
15. Evaporation and condensation are examples of chemical changes.
    True: Y (False: O)
16. When a physical change occurs, new substances are formed.
    True: S (False: D)

1	2	3	4	5	6	7	8	9	10
S	C	I	E	N	T	I	F	I	C

11	12	13	14	15	16
M	E	T	H	O	D

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NAME _____

Portable Lab Record Sheet

Substance	Melting Point °Celsius	Conductivity Y/N	Hydrochloric Acid Reaction	Nitric Acid Reaction	Results of Other Tests
iron	1535	Y	dissolves; H_2 released	dissolves	
lead	328	Y	no reaction	dissolves	
gold	1064	Y	no reaction	no reaction	
zinc	420	Y	dissolves, H_2 released	dissolves	
copper	1083	Y	no reaction	dissolves; forms blue solution	
silver	962	Y	no reaction	dissolves	
manganese	1244	Y	dissolves; H_2 released	dissolves	
hematite	no melting point	N	dissolves	dissolves	
chalcopyrite	no melting point	N	no reaction	dissolves; forms blue solution	
sphalerite	no melting point	N	dissolves, H_2S released	dissolves	
sulfur	119	N	no reaction	no reaction	
marble	no melting point	N	dissolves; CO_2 released	dissolves; CO_2 released	
carbon	no melting point; makes small flares	N	no reaction	no reaction	
pottery	no melting point	N	no reaction	no reaction	
bronze	1205	Y	no reaction	dissolves; forms blue solution	
shell	no melting point; decomposes when heated	N	dissolves; CO_2 released	dissolves; CO_2 released	
diamond	3500	N	no reaction	no reaction	
bone	no melting point; decomposes when heated	N	dissolves	dissolves	

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LOADING DISKS / KEYBOARD GUIDE

To load ***Investigating Chemical Reactions***, first turn on the monitor but not the computer. With your thumb on the disk label and the label facing up, insert the disk into the disk drive, oval cutout first. Then close the disk drive door and turn on the computer. The red light will come on, and the disk will whir. In a few seconds, the title screens will appear.

If nothing happens, check that the disk is positioned properly (label up). Make sure that the monitor is plugged into the computer and that all other connections are secure. Make sure that the computer and the monitor are plugged into an active power source. Then repeat the loading instructions.

After the title screens have appeared, you are warned not to use those tools and chemicals presented in the program in a real lab situation without proper care and supervision. Press RETURN and enter your name. The next screen asks if funds are available from a previous mission. Enter "Y" (yes) or "N" (no). If you enter "Y," you must enter the correct funding level. The next screen adds the option of sound to the program. After pressing RETURN, the Main Menu appears. You are now ready to select one of the sections of the program.

KEYBOARD GUIDE
INVESTIGATING CHEMICAL REACTIONS

USE	TO
RETURN	Advance a screen or lock an entry into place
ESC	Back up in the Portable Lab or return to a previous menu
?	Receive a HELP screen
SPACE BAR	Move highlighted box to your selection
Y	Answer "yes," where applicable
N	Answer "no," where applicable
LETTER KEYS (A–Z)	Enter a name or enter a funding code from a previous mission
NUMBER KEYS (1, 2)	Enter digits in a funding code

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CARE OF DISKS

DON'T

Don't touch the disk surface; hold the disk only by the label.

Don't bend it, fold it, or get it wet.

Don't use paper clips on it.

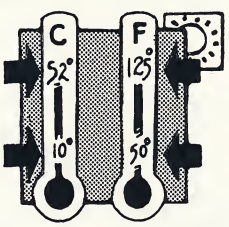
Don't place it on top of the monitor or on top of the disk drive.

Don't write on its label with a ballpoint pen or a pencil; use a felt-tipped pen with light pressure.

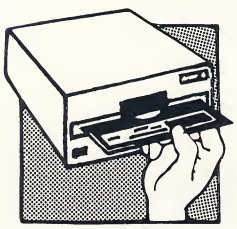
Don't put it where magnetic fields may damage it.

DO

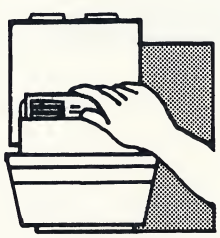
Do keep it in the protective envelope when it's not in use.



Do store it at 10°C to 52°C (50°F to 125°F) and keep it out of direct sunlight.



Do insert it into the disk drive carefully, with the label up and facing you.



Do keep it away from chalkboards and other dusty areas.

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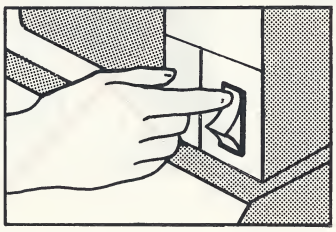
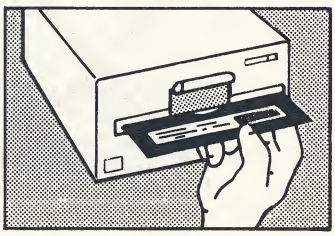
QUICK START

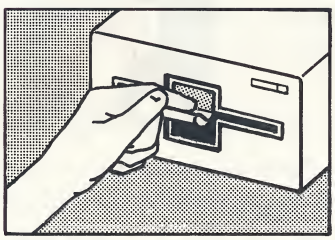
Apple® II Plus, IIe, IIc, or IIGS



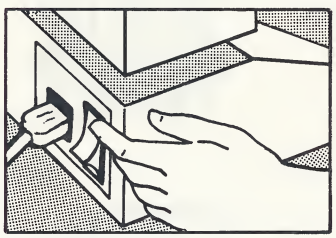
Turn on monitor.



Insert disk into disk drive, label side up.



Close disk drive door.



Turn on computer.

A B C D E F G H I J ESP 96 95 94 93 92 91 90 89 88 87

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SILVER BURDETT & GINN

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